SURFICIAL DEPOSITS OF PARTS OF THE FREDERICTON JUNCTION (21 G/10) AND McDOUGALL LAKE (21 G/7) MAP-AREAS

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INTRODUCTION

The study area is located south of Fredericton, New Brunswick. It corresponds to parts of the Fredericton Junction (21 G/10) and McDougall Lake (21 G/7) map-areas and covers approximately 800 km^2.

The area was originally selected by the New Brunswick Forest Site Classification Council as a testing ground for the development of a province-wide forest site classification system. Van Groenewoud and Ruitenberg (1982) have suggested such a system (see Table I).

Field investigations were conducted in 1982 to provide basic information necessary to define some of the parameters associated with the regolith system. Van Groenewoud and Ruitenberg's (1982) emphasis on the regolith system reflects the importance of the role played by surficial deposits on determining the sylvicultural qualities of a particular site. Landforms, texture, and lithologic-mineralogic composition of Quaternary deposits greatly influence drainage, permeability of soils and their capacity to produce and hold nutrients. A compositional-genetic classification of various surficial deposits gives clues as to these parameters and thus their nutrient potential. As noted by Chesworth (1982), Quaternary glaciations have revitalized the nutrient status of the landscape by scraping off products of an earlier weathering cycle, exposing fresh rock, and generating sediments that contain a high proportion of fresh rocks. The best soils are found where the fertility of the land surface has been

TABLE I

Hierarchical Levels of Proposed Forest Site Classification System

(van Groenewoud and Ruitenberg, 1982)

Unit	Description	Remarks
1. Climatic Region	A region having a distinctive climate delineated by multivariate statistical analysis of meteorological data.	These parameters constitute a broad control on forest growth and form the framework for meso- and microclimatic description.
2. Geomorphologic District	The surface expression of a major bedrock formation or group, modified by glaciation and fluvial erosion.	These parameters provide the first-order controls on drainage, topography, mesoclimate and nutrient supply.
3. Regolith System	a) Form and texture of landforms such as till, ablation till outwash, alluvial deposits, etc. (b) Lithologic-mineralogic composition (including percentage of material derived from different rock units and their secondary products) and structure (cleavage and fracturing) of the regolith material.	These parameters greatly affect drainage and limit nutrient availability within the regolith.
4. Site Type	a) Soil profile characteristics b) Microdrainage c) Slope d) Postion on slope e) Aspect f) Microclimate, etc.	All of these parameters influence soil chemistry and/or soil physical properties and/or local climate, and hence influence forest growth at the individual tree and stand level.

refreshed by geological processes operating in late Cenozoic times (see Table II).

This report contains a geological map showing the distribution of surficial deposits and landforms at a scale of 1:50,000 and an interpretation of the Quaternary landforms found in the study area.

TABLE II

Mean Compositions of Continental Runoff Expressed as the Sum of the Nutrient Ions Ca^{+2}, Mg^{+2}, Na^{+}, and K^{+} in ppm (Chesworth, 1982).

Continent	Sum of Nutrient Ions
Africa	12.6
Asia	29.1
Australia	10.9
Europe	33.6
North America	33.0
South America	12.0

PREVIOUS WORK

Early investigation and mapping in the area was done by Matthew (1879) and Chalmers (1890, 1902). In 1973, Gadd completed a study of the Quaternary geology of southwestern New Brunswick at a scale of 1:250,000. His report encompassed the present map-area and emphasized the regional patterns of deglaciation. Thibault (1981) completed a survey of the granular aggregate resources of the Fredericton Junction (21 G/10) and summarized his observations in a report accompanied by a 1:50,000 scale map. Wicklund et al. (1953) mapped the soils in southwestern New Brunswick.

PHYSIOGRAPHY, BEDROCK AND DRAINAGE

The study area lies within parts of the Maritime Plain and the New Brunswick Highlands (Bostock, 1970). The portion of the Maritime Plain lying within New Brunswick is known as the New Brunswick Lowland (Figure 1). The New Brunswick Highlands located south of the Saint John River have been designated as the St. Croix Highlands (Williams et al., 1972).

The New Brunswick Lowland is underlain by generally horizontally bedded Carboniferous sedimentary rocks. In the study area, the St. Croix Highlands consist mainly of a Mississippian volcanic complex and deformed Ordovician and Silurian sedimentary rocks (Figure 2).

The New Brunswick Lowland forms a plain of low relief with gentle slopes to the north. The Little Lake Road straddles more

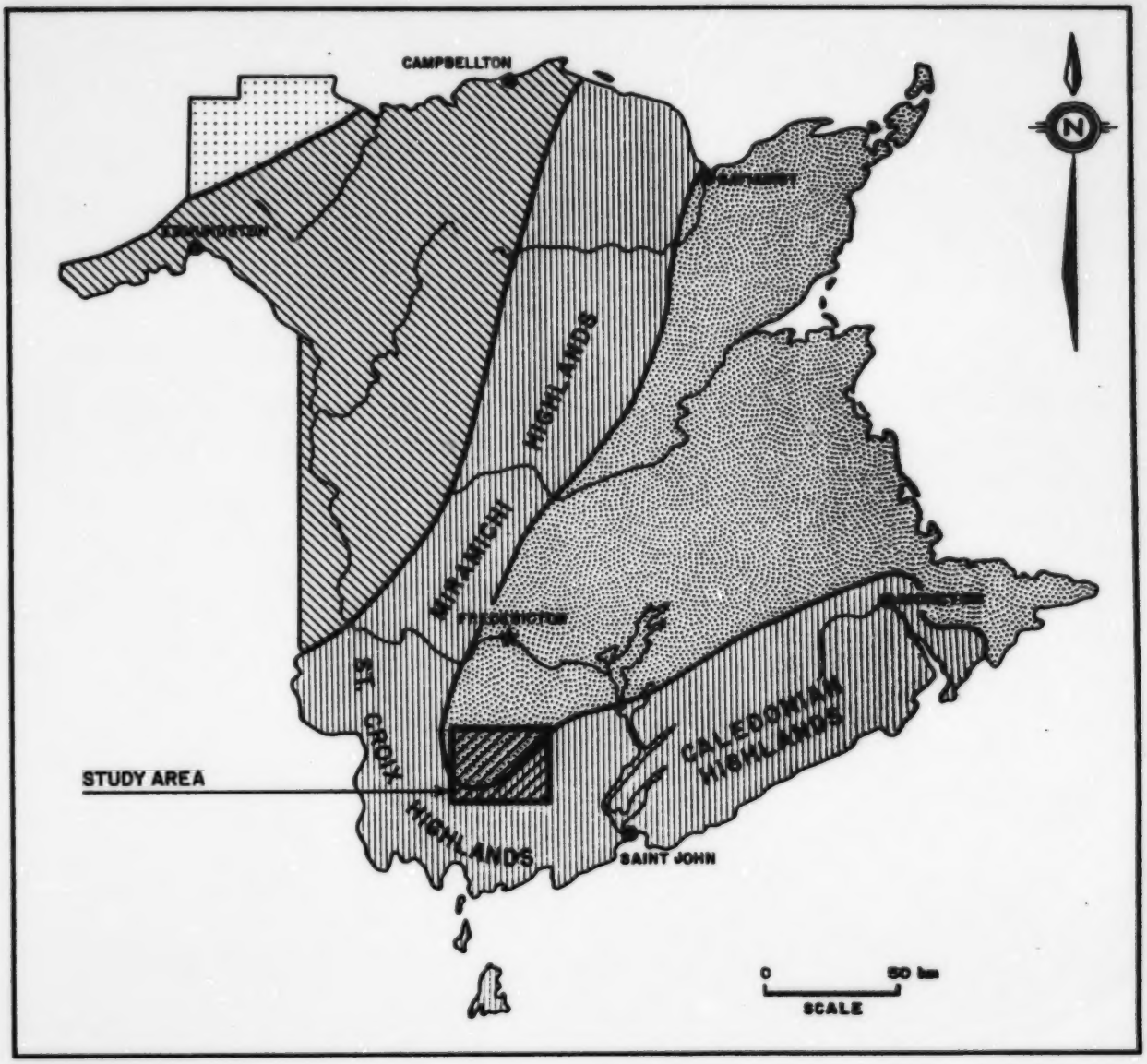

Figure 1 Physiographic map of New Brunswick (after Bostock, 1970 and Williams et al (1972) and location of the study area

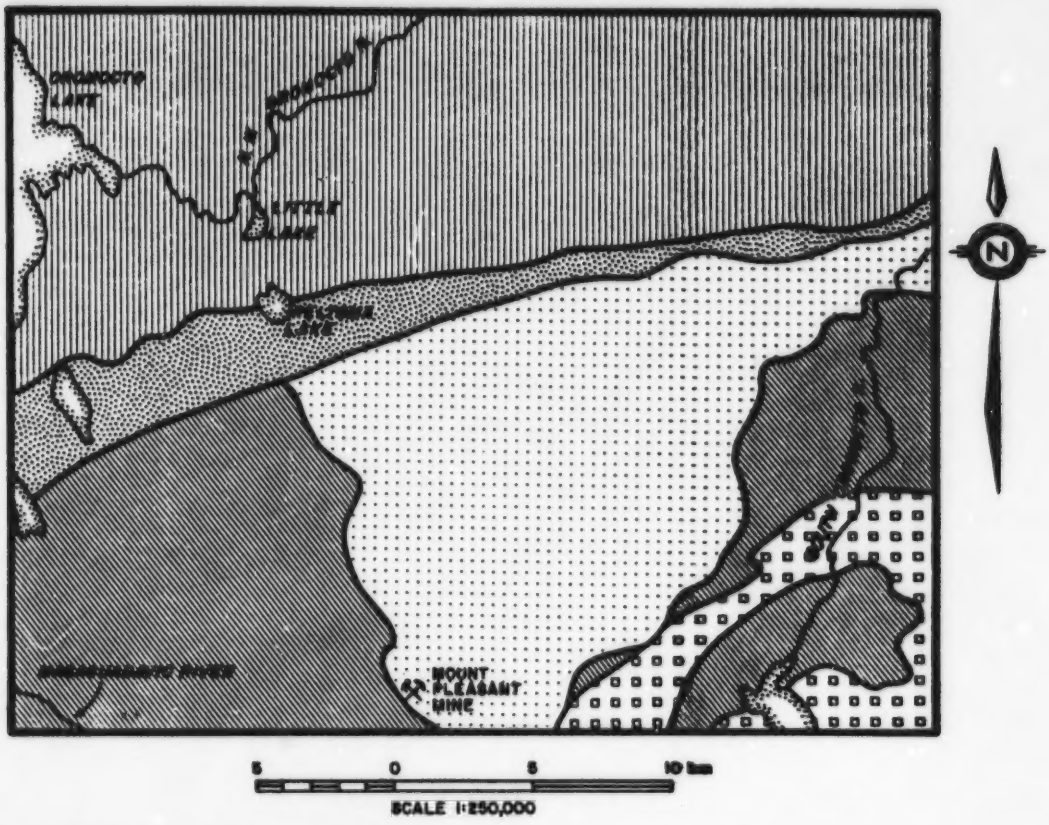
MOUNT PLEASANT MINE
5 0 5 10 km
SCALE 1:250,000
PENNSYLVANIAN OR YOUNGER
Grey to red sandstone, conglomerate, siltstone
MISSISSIPPIAN AND PENNSYLVANIAN
Red to grey sandstone, siltstone, conglomerate
MISSISSIPPIAN
Mainly silicic volcanic flows, tuffs and related intrusive rocks
DEVONIAN TO LOWER CARBONIFEROUS
Granite, quartz monzonite, granodiorite and related rocks
SILURIAN TO LOWER DEVONIAN
Greywacke and slate, sandstone and conglomerate

Figure 2 Generalized bedrock geology, modified after Potter et al (1979) and McCutcheon (1982)

resistant sandstone and conglomerate bedrock that stand as a cuesta ridge 40 m high above the surrounding plain. Most of the Lowland lies between 110 and 170 m elevation and shows only moderate to fair drainage because of its flatness. Drainage is further impeded by the presence of glacial deposits in the form of mounds and ridges.

The St. Croix Highlands form a group of hills that rise from elevations of 120 m up to 370 m at Mt. Pleasant. Drainage throughout the Highlands is good because of the relief, although valleys are locally poorly drained because of obstruction by glacial deposits.

SURFICIAL GEOLOGY

The combined effects of weathering, glaciation, paludification, alluviation and stream erosion have led to the development of the present landforms, which are composed of a variety of materials. The landforms and materials resulting from these activities are shown on the accompanying map (in pocket).

DESCRIPTION OF MAP-UNITS

Units on the accompanying map are described by a series of letter symbols that generally follow Rampton et al.'s (1981) system. In this mapping system, the letters designate the compositional-genetic category, the texture and the morphology of a map-unit. Compositional-genetic categories connote a possible variety and arrangement of landforms and a variety of textural variations within the landforms, both laterally and with depth. A

textural prefix and morphologic suffix indicate the texture and morphology where applicable.

BEDROCK (R)

This unit includes rock that is frequently present at or near the surface. Small areas of drift, more than one metre thick, may be present.

Although isolated outcrops are common throughout most of the area, much of the bedrock is thinly veneered with drift. Bedrock is mainly restricted to high ridges within the Mississippian volcanic rock complex (e.g. summits in the Juvenile Hills area). Only the more continuous exposures have been mapped as bedrock.

Naturally exposed bedrock surfaces generally show the effects of weathering, although some surfaces still exhibit the effects of glacial erosion and scour. Weathering may take the form of fracturing and disintegration, or of a chemical and physical alteration of the surface. The depth of effective weathering and bedrock disintegration generally varies from negligible to one metre. The intensity and the type of weathering is intimately associated with the lithology and structural character of the bedrock.

UNDIFFERENTIATED DEPOSITS AND LANDFORMS

COLLUVIUM (C)

Colluvium is mainly restricted to valleys with adequate slopes and the required thickness of weathered material to allow

down-slope movement of materials by mass movement (generally slow creep), and hill slopes where rock weathering and disintegration has produced a relatively continuous regolith that mantles the underlying bedrock surface.

Material mapped as colluvium consists primarily of weathered and disintegrated local bedrock, commonly occurring as boulder pavement surfaces (e.g. Seelys Lake boulder fields). Most colluvium is probably postglacial in age and some may reflect periglacial activity during and immediately following deglaciation.

GLACIAL DEPOSITS AND LANDFORMS

MORAINAL DEPOSITS (M)

Morainal deposits usually consist of ablation or lodgement till but can also contain glaciofluvial deposits and even glaciolacustrine deposits. The term "morainal deposits" rather than "till" has been favoured because of the complex interrelationships involved and the lack of detailed information in some parts of the field area.

In many localities where the thickness of unconsolidated sediment over bedrock is relatively thin, it is difficult to separate bedrock that has been weathered, shattered, frost-heaved and mixed with whatever surficial materials were present, from morainal deposits which contain clasts that have been weathered and shattered. This is particularly true where morainal deposits contain a superabundance of local lithologies which break to angular clasts.

Identification of ablation and lodgement till is difficult in some areas where till is relatively thin and may be affected by soil processes throughout its thickness. Commonly, in areas mapped as being covered by lodgement till (Mr, Mb) the till in the upper 10 to 50 cm is relatively loose and may in fact be an ablation till veneer.

Lodgement till (Mr, Mb): Areas showing little evidence of hummocky, rolling or ridge topography, and containing few ice-contact deposits have been mapped as lodgement till.

In the eastern part of the study area, associated with a southerly flow of the ice, the lodgement till (Mr) is typically reddish-brown (5YR 4/3) and tends to be dominantly clayey and silty. The color and the fine matrix characteristic of this till is related to an up-ice region of soft and erodible reddish Carboniferous sedimentary rocks. Although the lithology of the coarse fragments in the till varies as different bedrock types are encountered, the reddish fine matrix is ubiquitous over most of the east half of the study area, irrespective of the bedrock type encountered.

In the western part of the area, the till (Mb) varies from light olive brown (2.5Y 5/4) to yellowish brown (10YR 5/4) and tends to be more sandy, a reflection of the different ice flow direction and coarser textured bedrock lithologies encountered by the glacier.

Ablation moraine (Mm): Large areas of ablation moraine are present north of Little Lake, north of Little McDougall Lake, in the vicinity of Black Brook and commonly in the main valleys

crossing the hilly volcanic complex. Ablation moraine is characteristically ridged or ribbed. It is also usually moderately loose, coarse textured and poorly sorted. Pockets of well sorted stratified sand and gravel occur locally.

The source material of this ablation till is usually debris that is carried high in the ice (englacial) or on the surface of the ice (supraglacial); the debris is melted out of the glacier by various mass wasting processes during deglaciation. In general, ablation deposits tend to be dominated by the higher ground lithologies (e.g. volcanic rocks from the local summits) or by distant elements of the dispersal area (e.g. granite erratics from the Pokiok area to the northwest).

GLACIOFLUVIAL DEPOSITS (G)

Glaciofluvial deposits include those sediments deposited in contact with glacial ice (ice-contact stratified drift) and those deposited proglacially (outwash). Ice-contact stratified drift and outwash are often found in close association (Gx).

Ice-contact deposits: Eskers and esker-like ridges (Gr), Kames (Gh) and Kame-and-kettle complexes (Gm) are the main landforms in which ice-contact stratified drift is present. These three landform types are commonly associated with each other or with ablation moraine. These deposits characteristically comprise well to poorly sorted sand and gravel and may include varying proportions of silt and clay. Sharp textural differences between adjacent beds of sedimented material are common. These deposits also very often exhibit deformation structures and may contain

till inclusions.

Outwash: Valley trains (Gp) constitute most of the outwash in the area. Where the outwash mantles the bedrock and is generally less than 0.5 m thick, it has been mapped as a veneer (Gv). Outwash typically consists of well sorted sand and gravel. The content of fine particles is usually low because the glacial meltwaters tend to carry the fines farther downstream.

LATE GLACIAL AND POSTGLACIAL DEPOSITS

LACUSTRINE DEPOSITS (L)

Glaciolacustrine sediments have been mapped north of Seelys Mountain in the Shin Creek valley; other small occurrences of lacustrine or glaciolacustrine sediments have also been noted elsewhere in the study area, commonly associated with valley ablation moraine. Coarse and fine facies are present. The extensive bogs southwest of Peltoma Lake, in the Piskahegan Stream valley, may have been shallow lakes at one time.

ORGANIC DEPOSITS (O)

Organic deposits are common on the New Brunswick Lowland, especially south of Peltoma Lake, in the Piskahegan Stream valley. Organic deposits are also distributed throughout the St. Croix Highlands. Most of the large bogs contain peat in excess of 2 m in depth. Small bogs are generally underlain by thinner peat. The upper part of most peat bogs consists of Sphagnum, whereas at depth, a variety of peat types and mucks are found. Silt, clay and sand may be interbedded with peat and muck where lakes have

been infilled.

ALLUVIAL DEPOSITS (A)

Flood plains and terraces of postglacial rivers have been mapped together. The sediments consist mainly of sand and silt, although gravel is sometimes present.

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Note: Map Plate 84-33 to accompany report.